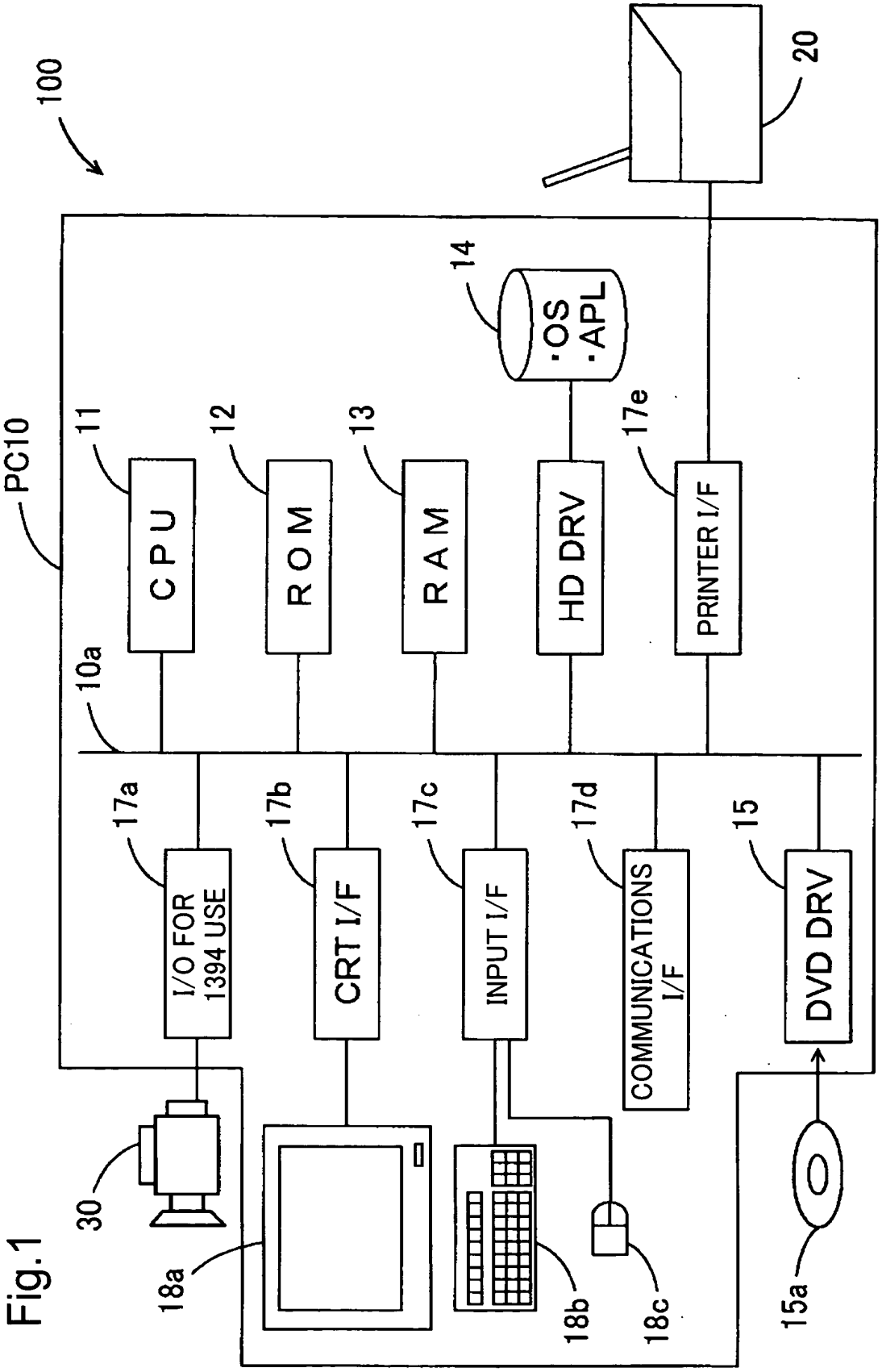

100
20
PC10
14
·OS
·APL
11
12
13
17e
CPU
ROM
RAM
HD DRV
PRINTER I/F
10a
17a
17b
17c
17d
15
I/O FOR
1394 USE
CRT I/F
INPUT I/F
COMMUNICATIONS
I/F
DVD DRV
30
18a
18b
18c
15a

Fig.1

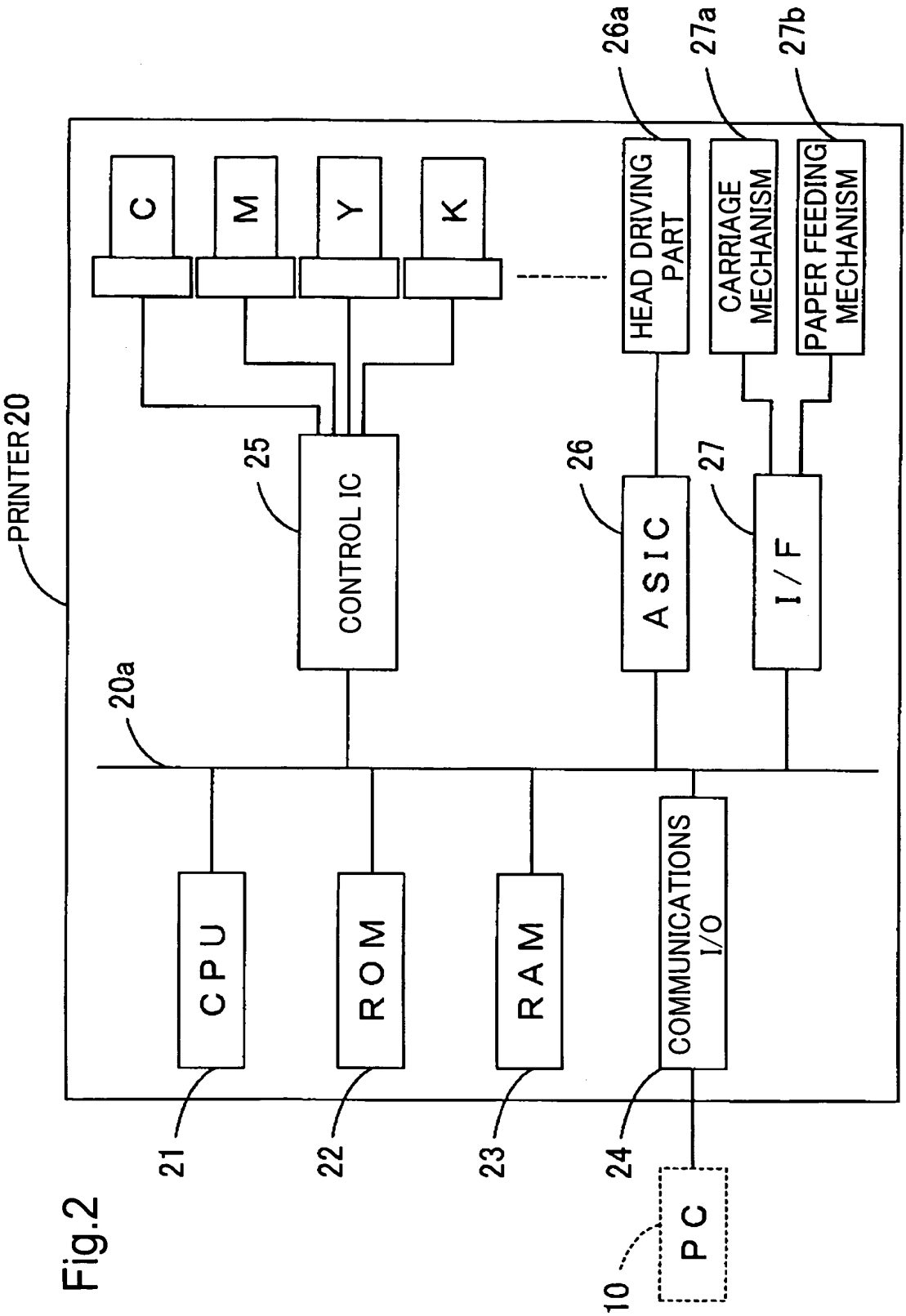

PRINTER 20
C
M
Y
K
HEAD DRIVING PART
CARRIAGE MECHANISM
PAPER FEEDING MECHANISM
26a
27a
27b
25
CONTROL IC
26
ASIC
27
I/F
20a
CPU
ROM
RAM
COMMUNICATIONS I/O
21
22
23
24
10
PC

Fig.2

Fig.3

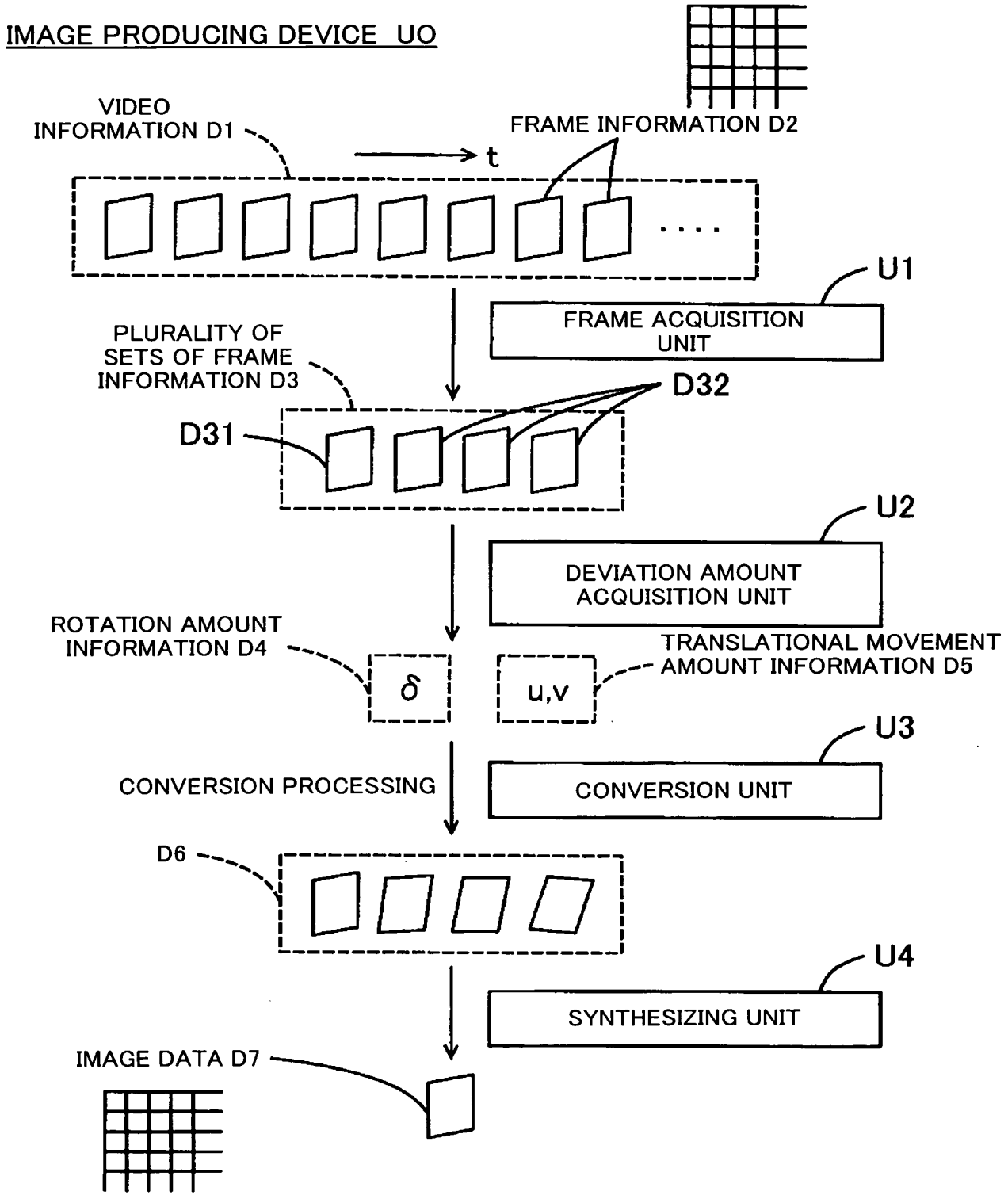


IMAGE PRODUCING DEVICE UO
VIDEO INFORMATION D1
t
FRAME INFORMATION D2
U1
FRAME ACQUISITION UNIT
PLURALITY OF SETS OF FRAME INFORMATION D3
D31
D32
U2
DEVIATION AMOUNT ACQUISITION UNIT
ROTATION AMOUNT INFORMATION D4
δ
u,v
TRANSLATIONAL MOVEMENT AMOUNT INFORMATION D5
U3
CONVERSION PROCESSING
CONVERSION UNIT
D6
U4
SYNTHESIZING UNIT
IMAGE DATA D7

Fig.4

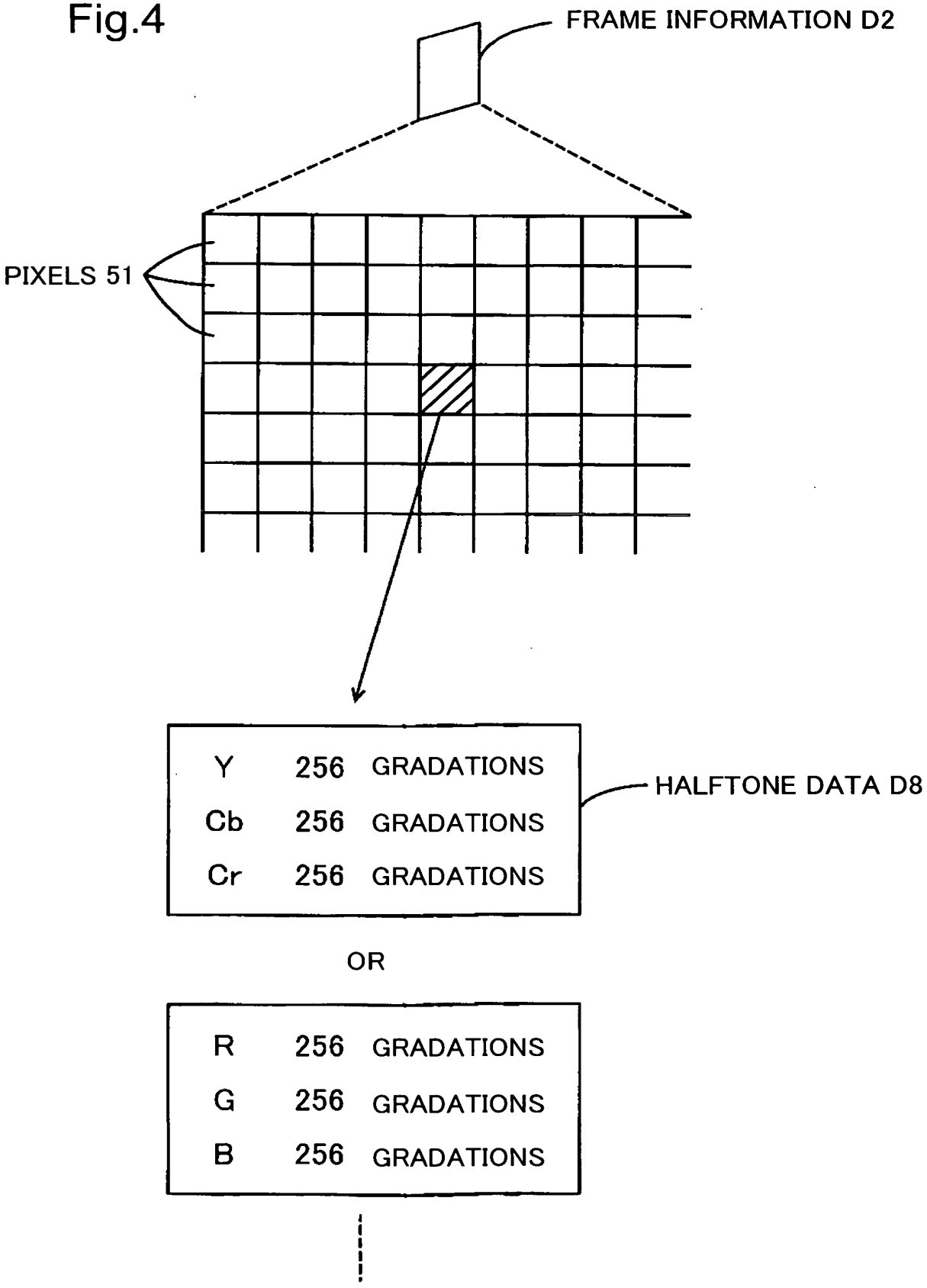
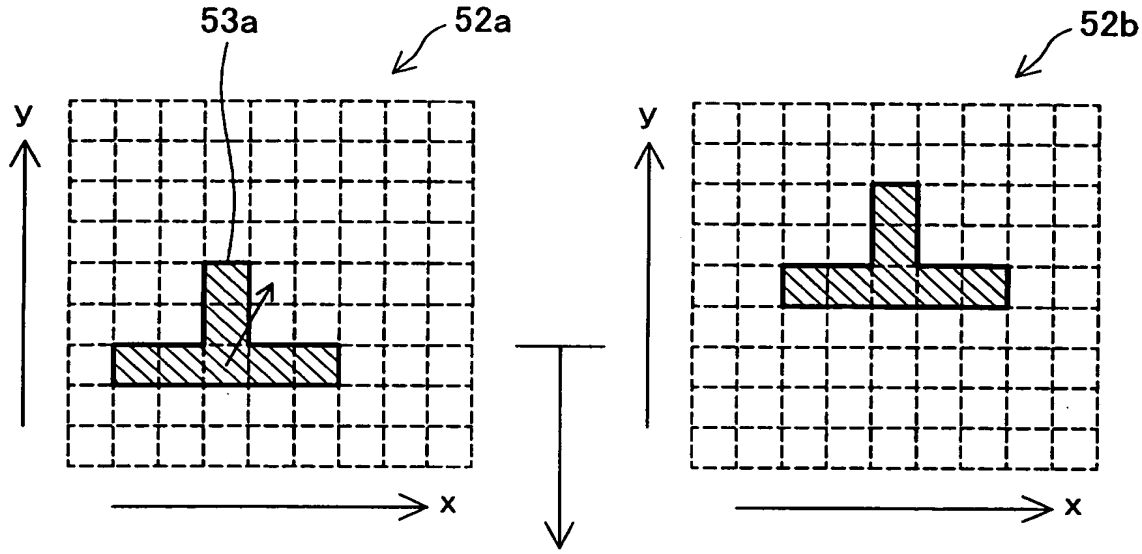
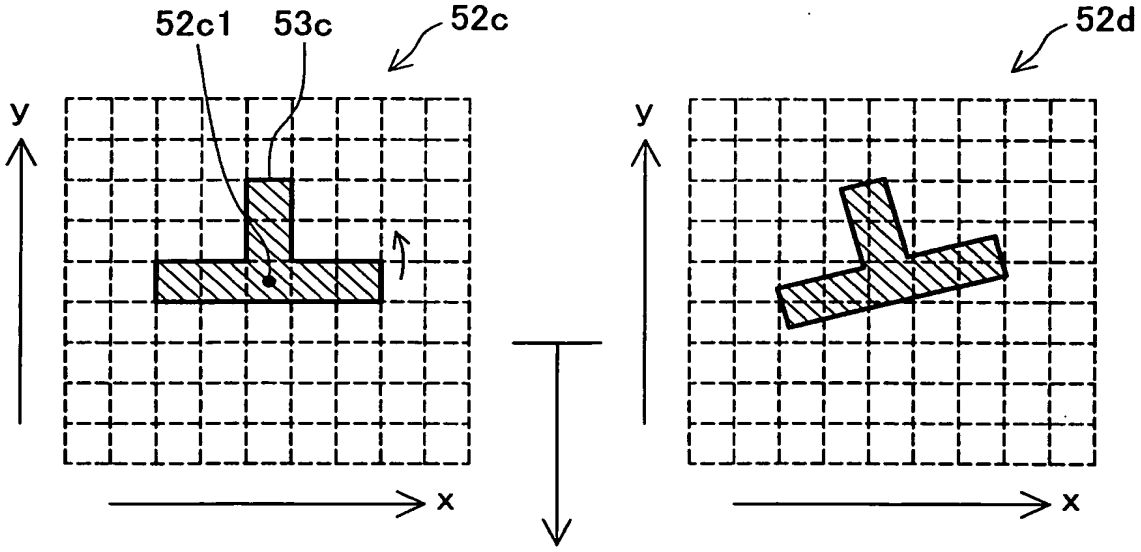

FRAME INFORMATION D2
PIXELS 51
Y 256 GRADATIONS
Cb 256 GRADATIONS
Cr 256 GRADATIONS
HALFTONE DATA D8
OR
R 256 GRADATIONS
G 256 GRADATIONS
B 256 GRADATIONS

Fig.5



TRANSLATIONAL DEVIATION AMOUNT (ua, va) = (1, 2)



ROTATIONAL DEVIATION AMOUNT (δ a)

Fig.6

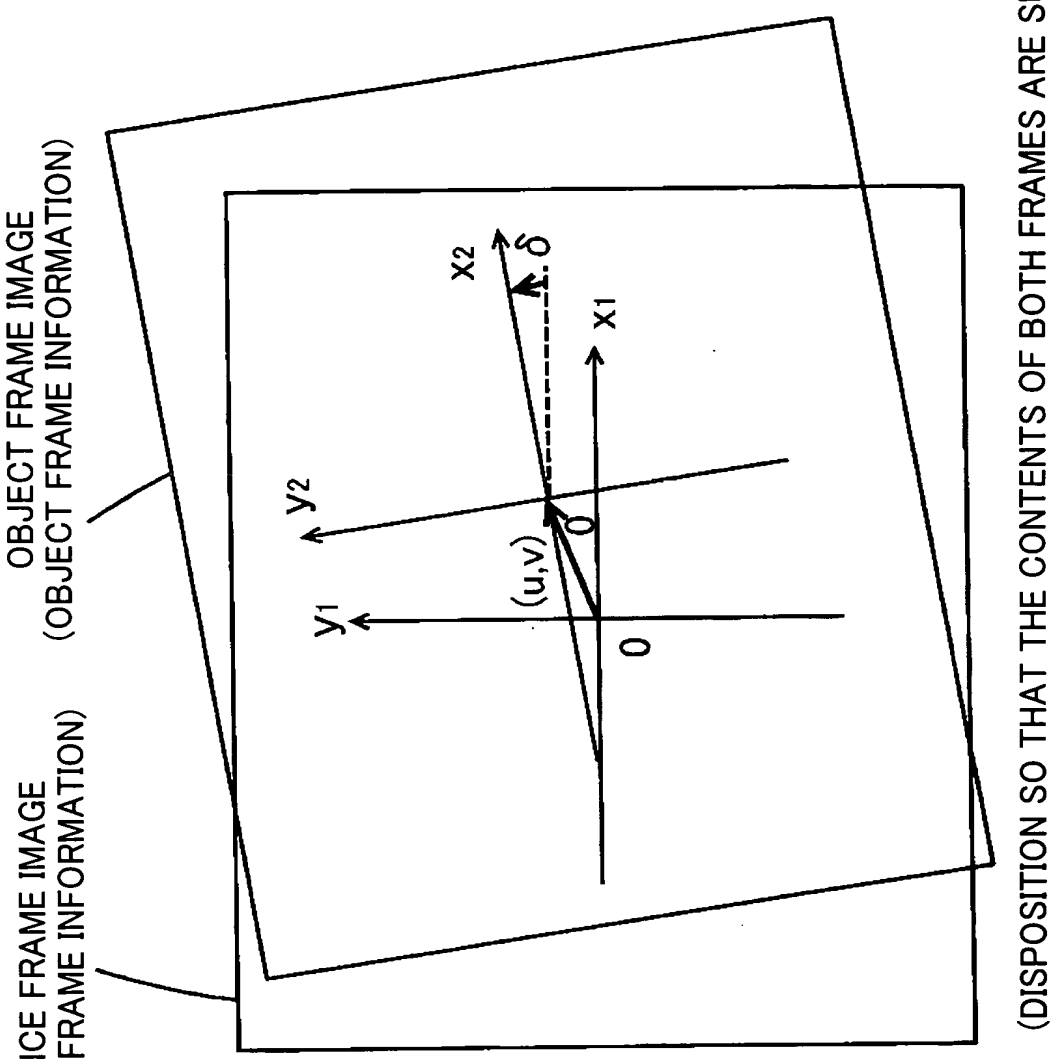

OBJECT FRAME IMAGE
(OBJECT FRAME INFORMATION)
REFERENCE FRAME IMAGE
(REFERENCE FRAME INFORMATION)
x2
δ
x1
y2
θ
(u,v)
y1
0
(DISPOSITION SO THAT THE CONTENTS OF BOTH FRAMES ARE SUPERIMPOSED)

Fig.7

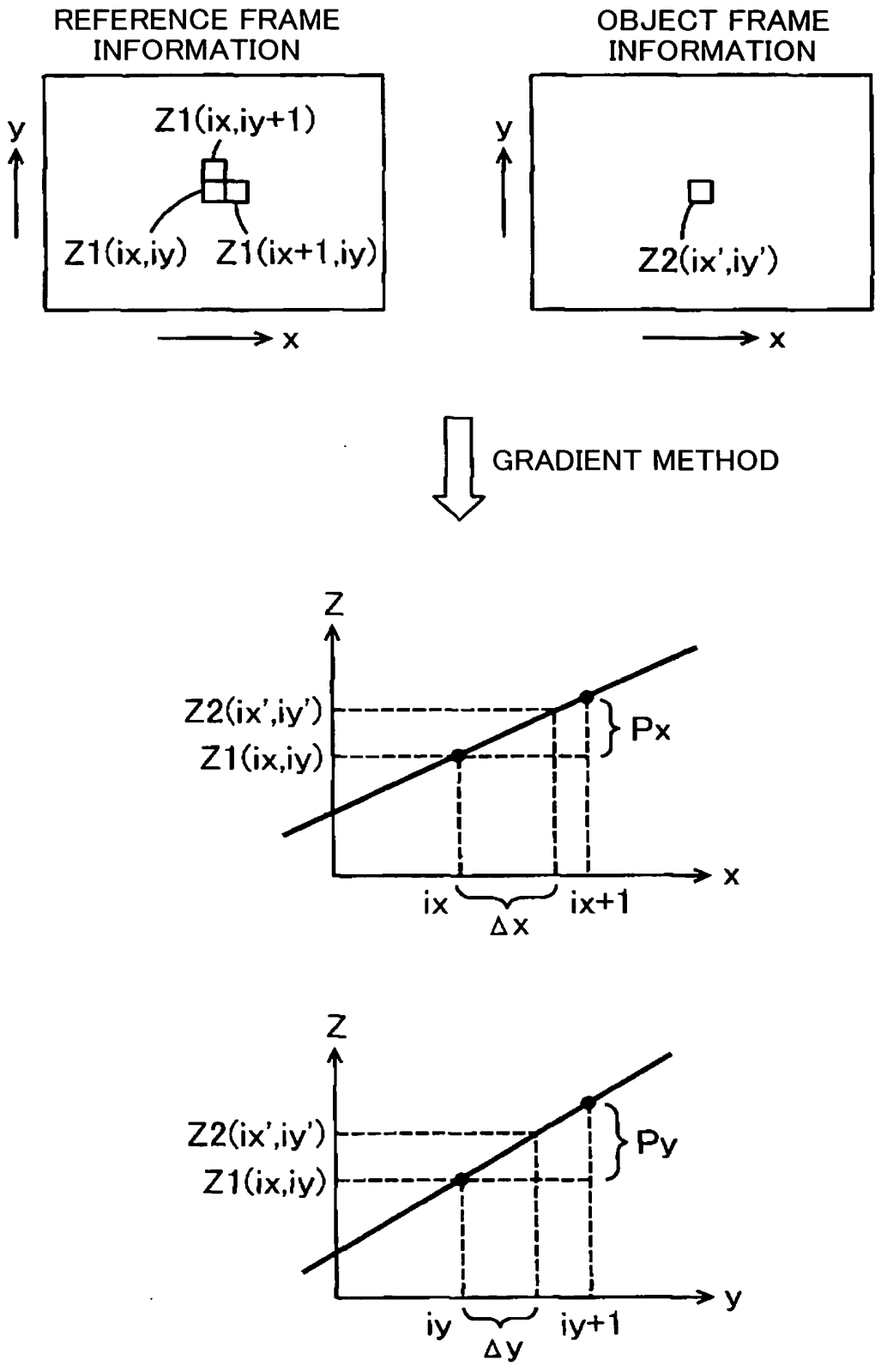

REFERENCE FRAME INFORMATION
OBJECT FRAME INFORMATION
y
x
Z1(ix,iy+1)
Z1(ix,iy)
Z1(ix+1,iy)
Z2(ix',iy')
GRADIENT METHOD
Z
Z2(ix',iy')
Z1(ix,iy)
Px
ix
ix+1
Δx
Py
iy
iy+1
Δy

Fig.8

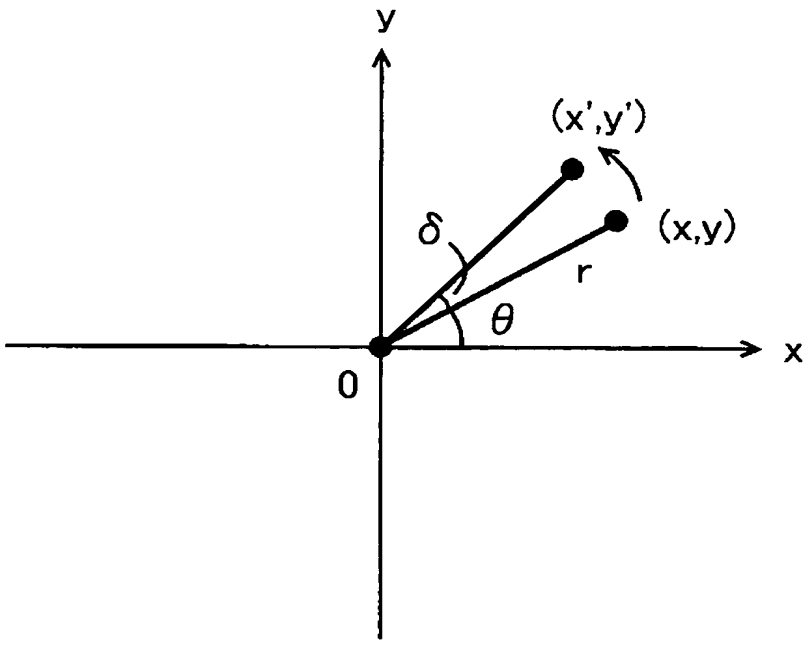
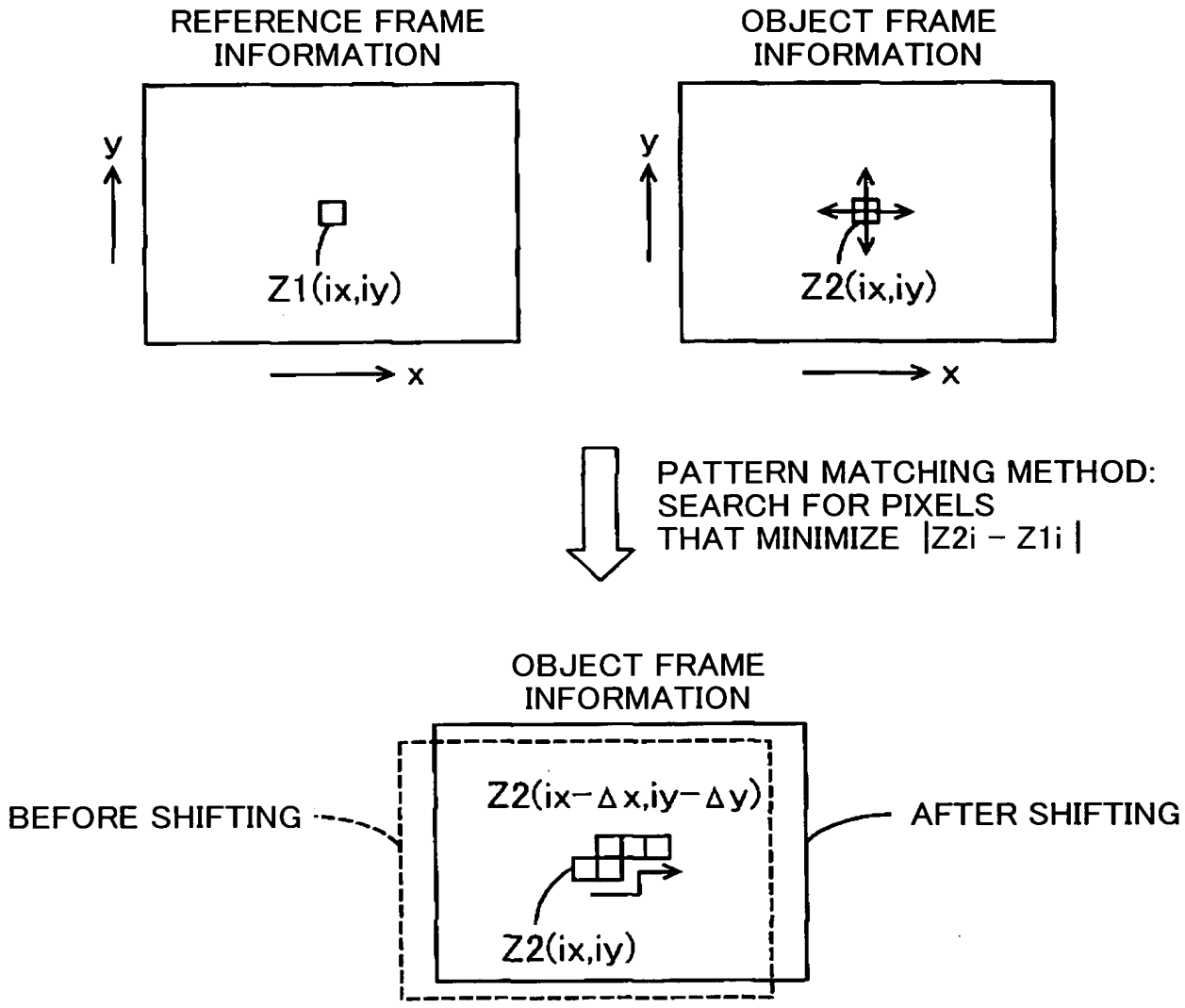


Fig.9



AMOUNT OF TRANSLATIONAL MOVEMENT IN PIXEL UNITS = (Δx, Δy)

Fig.10

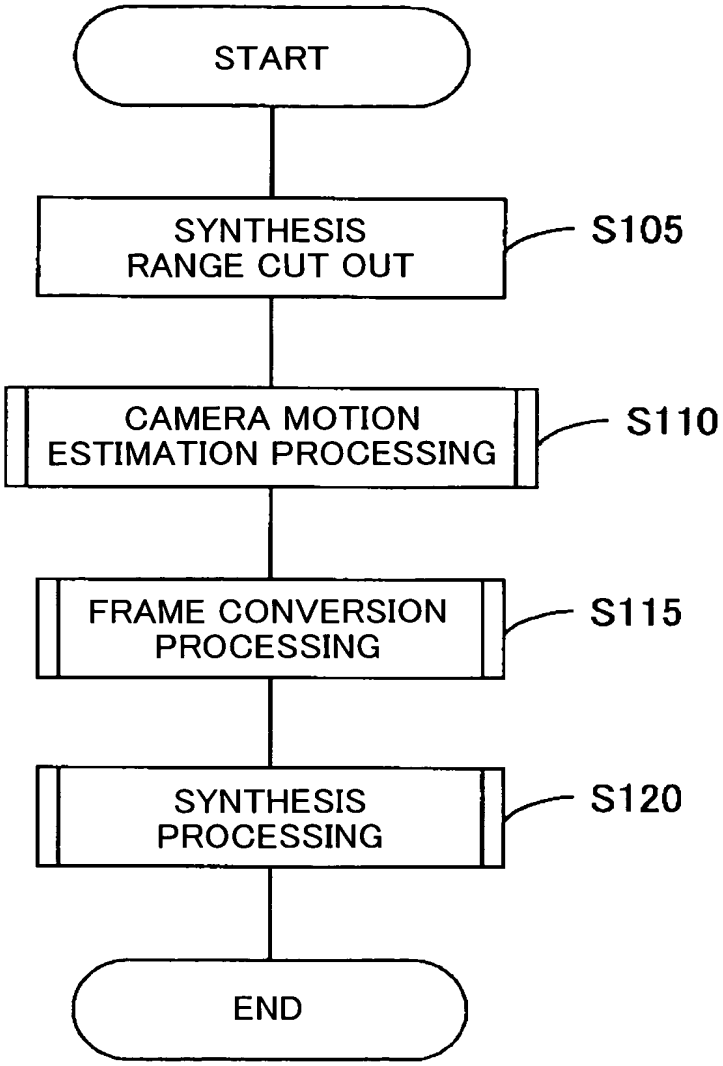

START
SYNTHESIS RANGE CUT OUT
S105
CAMERA MOTION ESTIMATION PROCESSING
S110
FRAME CONVERSION PROCESSING
S115
SYNTHESIS PROCESSING
S120
END

Fig.11

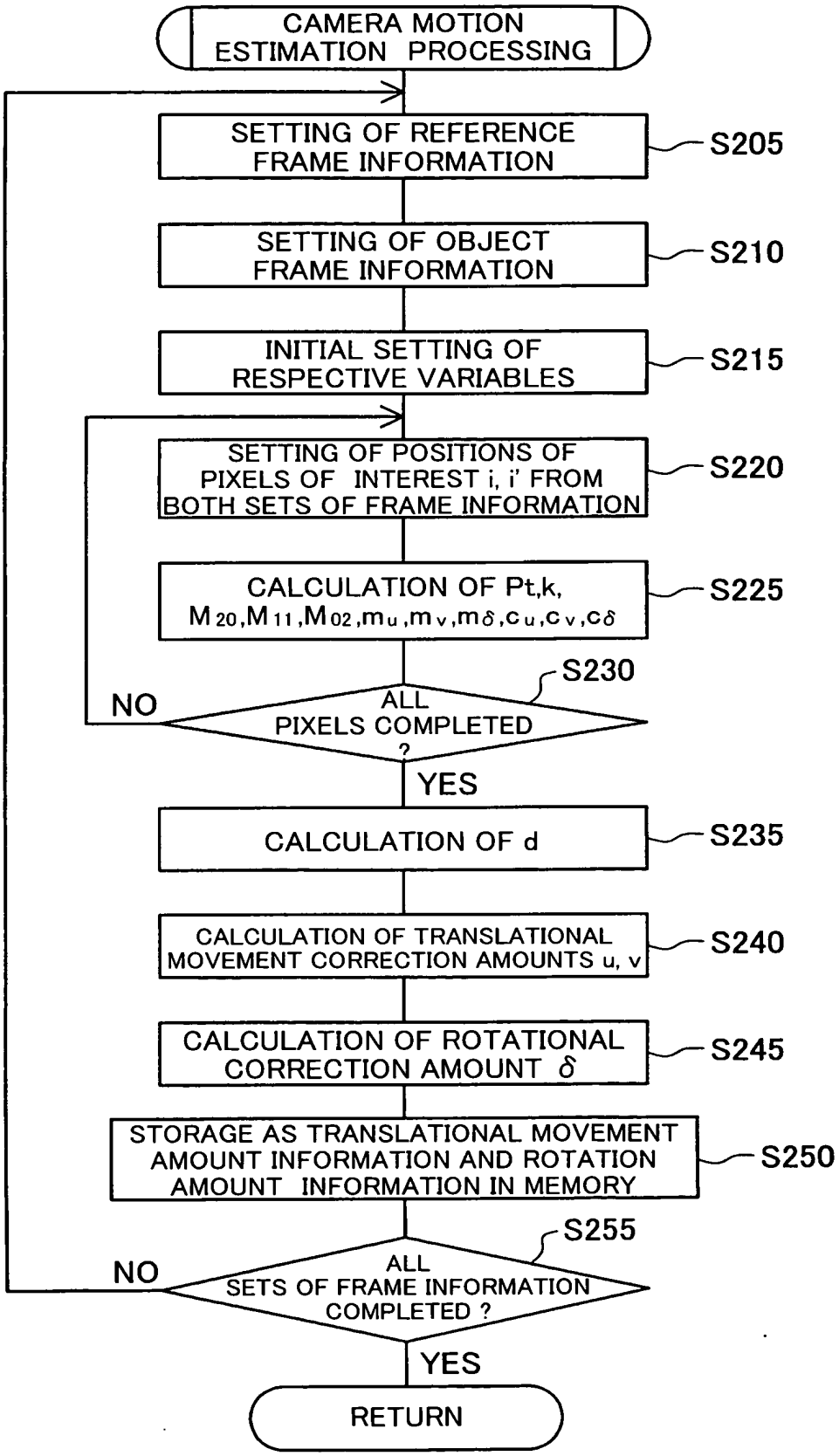

CAMERA MOTION ESTIMATION PROCESSING
SETTING OF REFERENCE FRAME INFORMATION
S205
SETTING OF OBJECT FRAME INFORMATION
S210
INITIAL SETTING OF RESPECTIVE VARIABLES
S215
SETTING OF POSITIONS OF PIXELS OF INTEREST i, i' FROM BOTH SETS OF FRAME INFORMATION
S220
CALCULATION OF Pt,k, M20,M11,M02,mu,mv,mδ,cu,cv,cδ
S225
S230
ALL PIXELS COMPLETED ?
NO
YES
CALCULATION OF d
S235
CALCULATION OF TRANSLATIONAL MOVEMENT CORRECTION AMOUNTS u, v
S240
CALCULATION OF ROTATIONAL CORRECTION AMOUNT δ
S245
STORAGE AS TRANSLATIONAL MOVEMENT AMOUNT INFORMATION AND ROTATION AMOUNT INFORMATION IN MEMORY
S250
S255
ALL SETS OF FRAME INFORMATION COMPLETED ?
NO
YES
RETURN

Fig.12

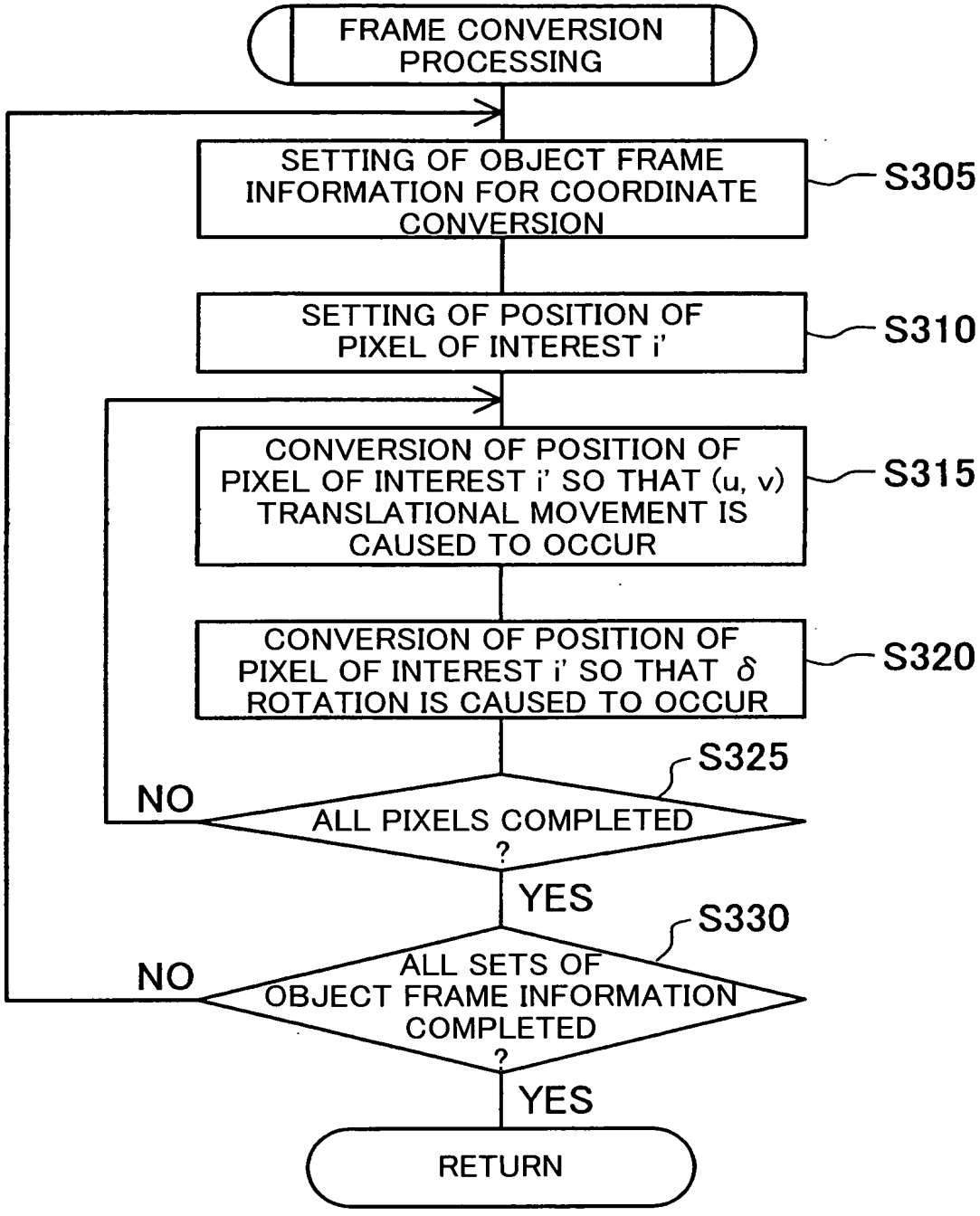

FRAME CONVERSION PROCESSING
SETTING OF OBJECT FRAME INFORMATION FOR COORDINATE CONVERSION
S305
SETTING OF POSITION OF PIXEL OF INTEREST i'
S310
CONVERSION OF POSITION OF PIXEL OF INTEREST i' SO THAT (u, v) TRANSLATIONAL MOVEMENT IS CAUSED TO OCCUR
S315
CONVERSION OF POSITION OF PIXEL OF INTEREST i' SO THAT δ ROTATION IS CAUSED TO OCCUR
S320
S325
NO
ALL PIXELS COMPLETED ?
YES
S330
NO
ALL SETS OF OBJECT FRAME INFORMATION COMPLETED ?
YES
RETURN

Fig.13

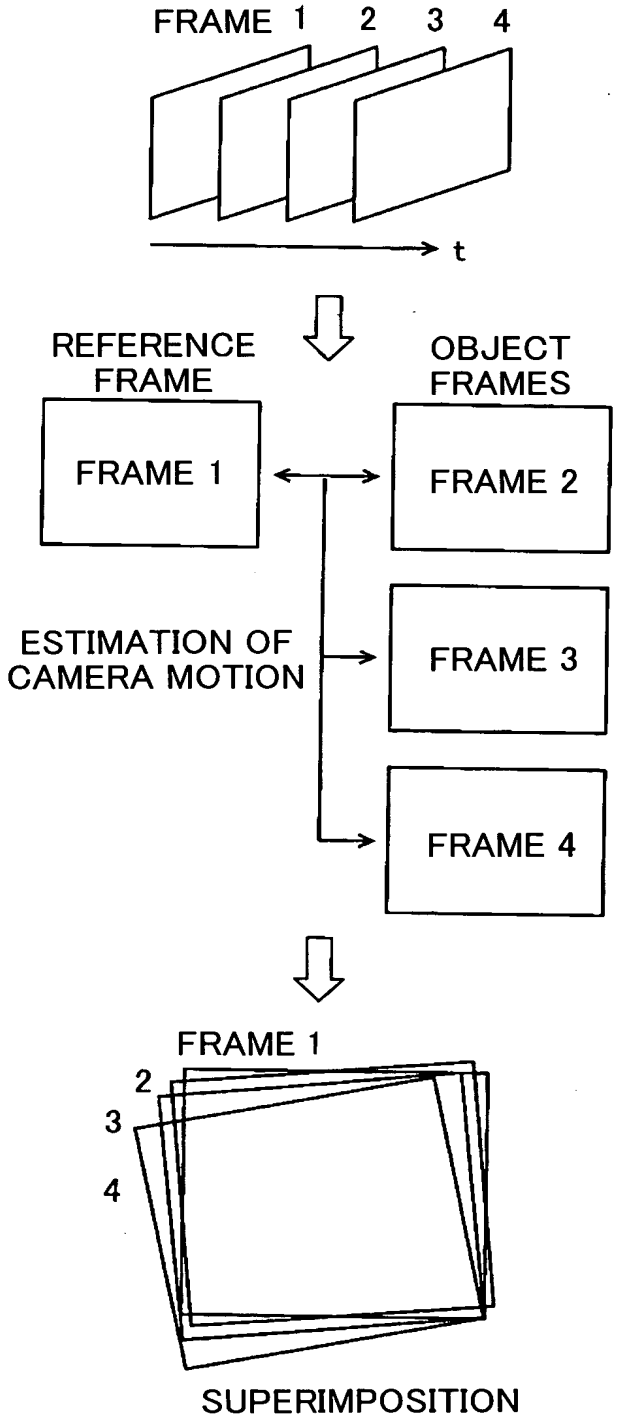

FRAME 1 2 3 4
t
REFERENCE FRAME
OBJECT FRAMES
FRAME 1
FRAME 2
ESTIMATION OF CAMERA MOTION
FRAME 3
FRAME 4
FRAME 1
2
3
4
SUPERIMPOSITION

Fig.14

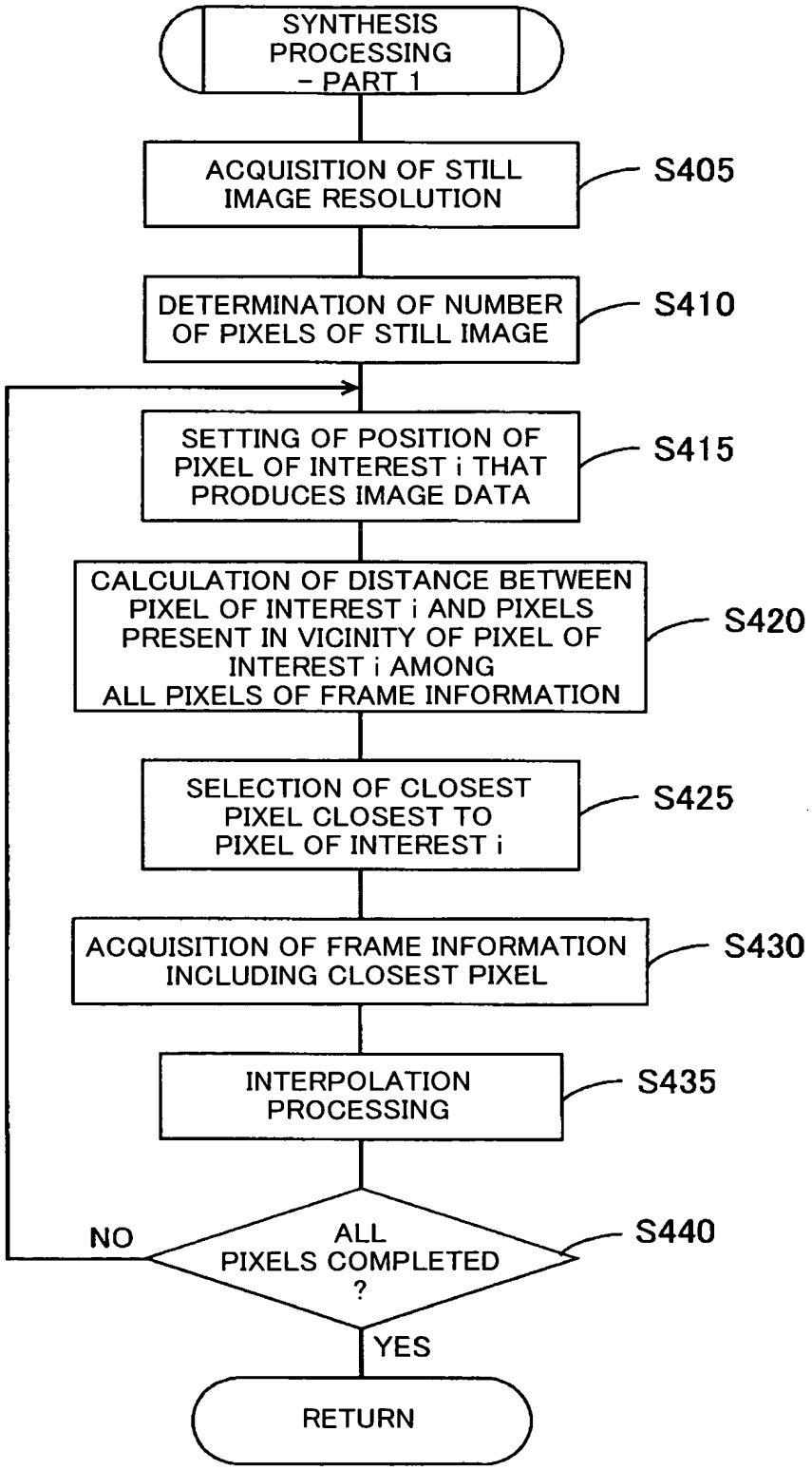
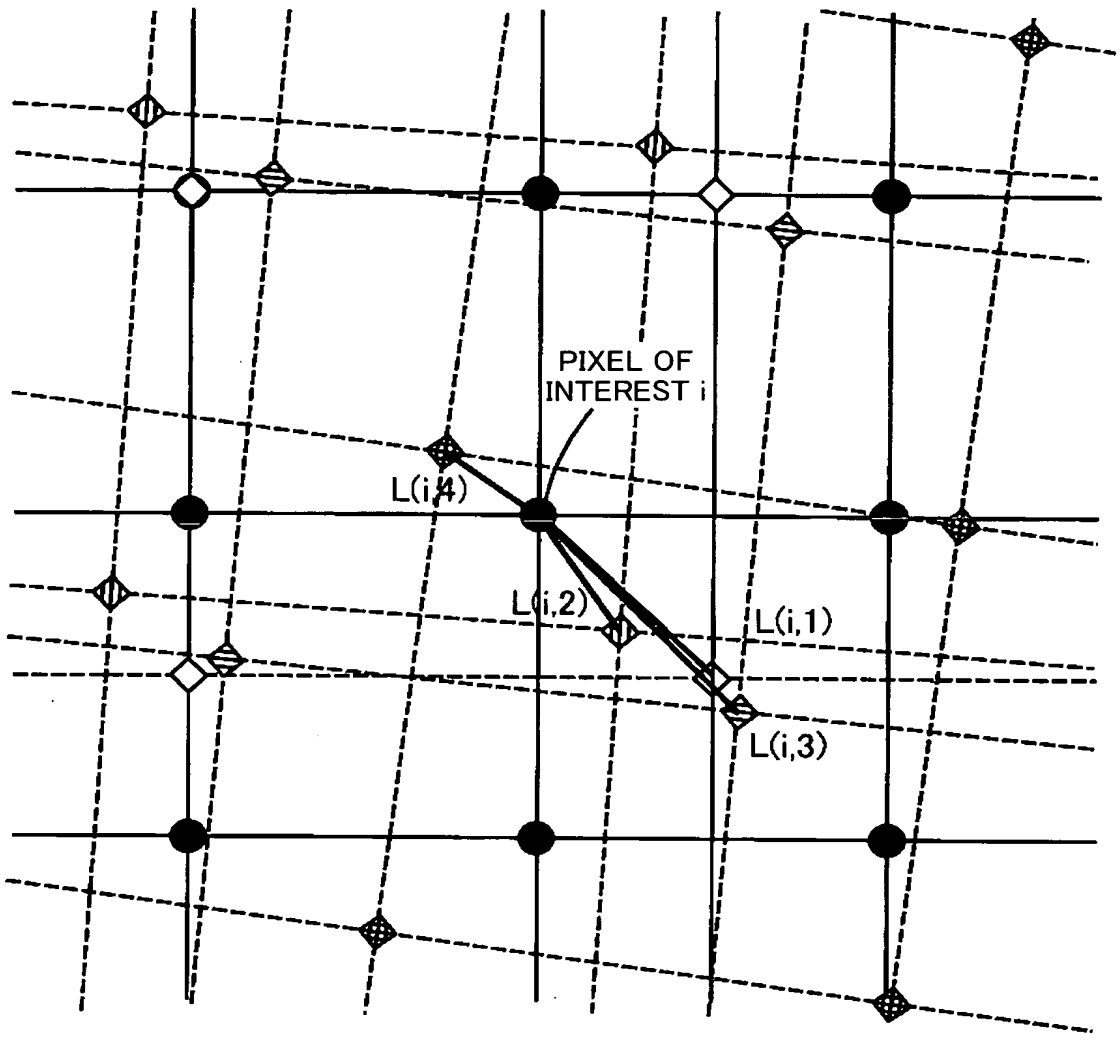

SYNTHESIS PROCESSING - PART 1
ACQUISITION OF STILL IMAGE RESOLUTION
S405
DETERMINATION OF NUMBER OF PIXELS OF STILL IMAGE
S410
SETTING OF POSITION OF PIXEL OF INTEREST i THAT PRODUCES IMAGE DATA
S415
CALCULATION OF DISTANCE BETWEEN PIXEL OF INTEREST i AND PIXELS PRESENT IN VICINITY OF PIXEL OF INTEREST i AMONG ALL PIXELS OF FRAME INFORMATION
S420
SELECTION OF CLOSEST PIXEL CLOSEST TO PIXEL OF INTEREST i
S425
ACQUISITION OF FRAME INFORMATION INCLUDING CLOSEST PIXEL
S430
INTERPOLATION PROCESSING
S435
ALL PIXELS COMPLETED ?
S440
NO
YES
RETURN

Fig.15



● PIXELS OF PRODUCED IMAGE

◇ PIXELS OF FRAME 1 ◈ PIXELS OF FRAME 2

◈ PIXELS OF FRAME 3 ◆ PIXELS OF FRAME 4

Fig.16

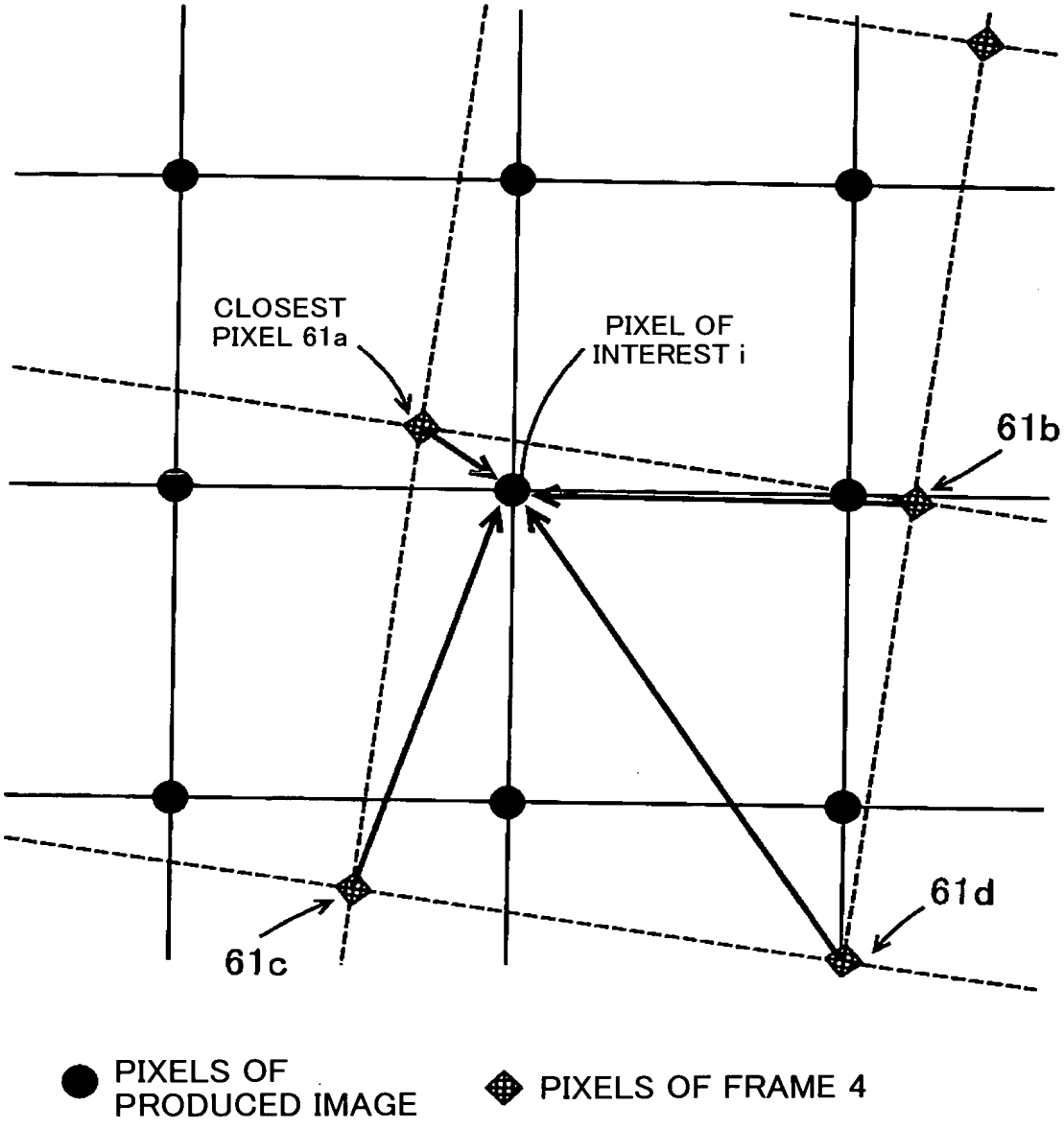

CLOSEST
PIXEL 61a
PIXEL OF
INTEREST i
61b
61c
61d
PIXELS OF
PRODUCED IMAGE
PIXELS OF FRAME 4

Fig.17

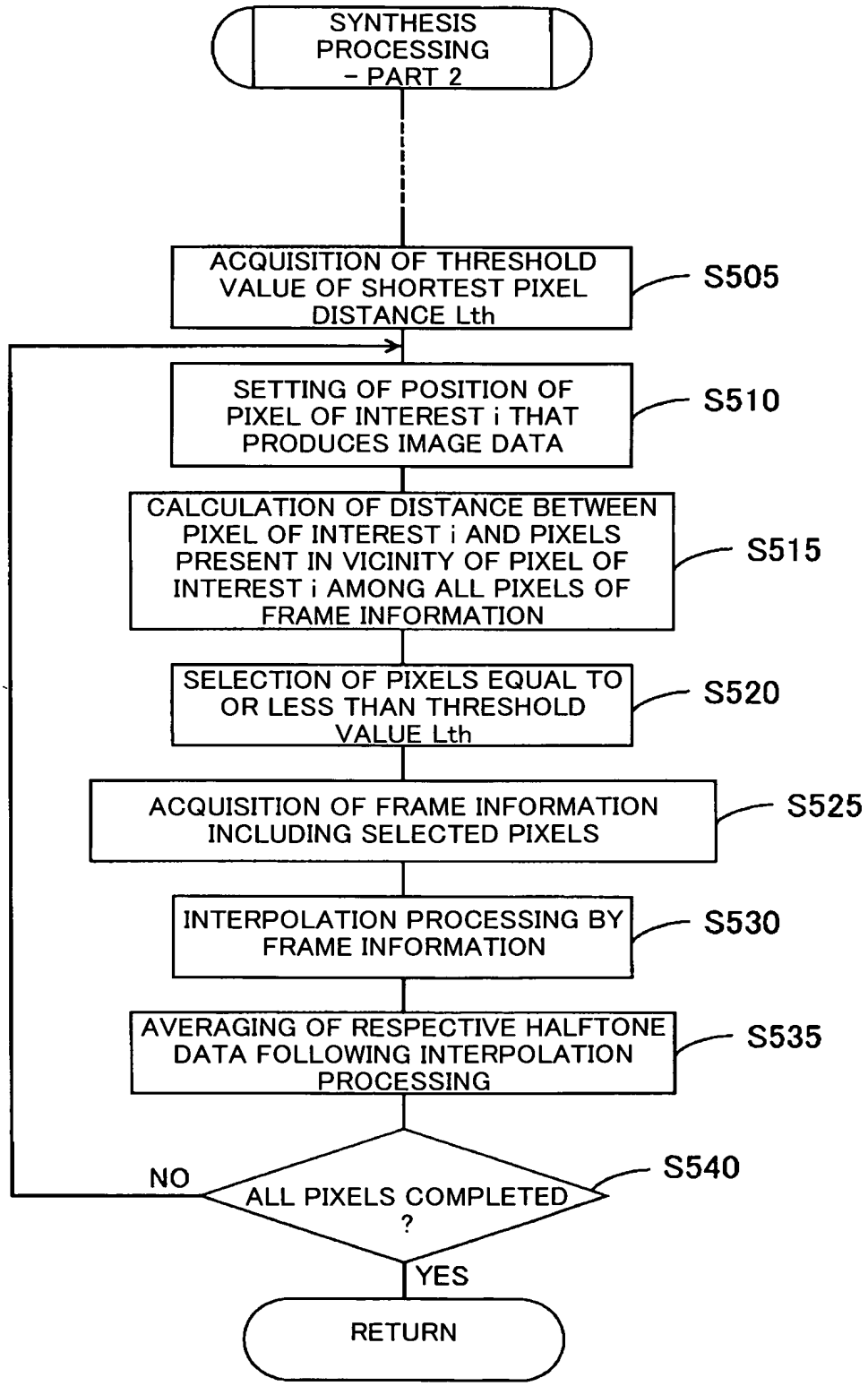
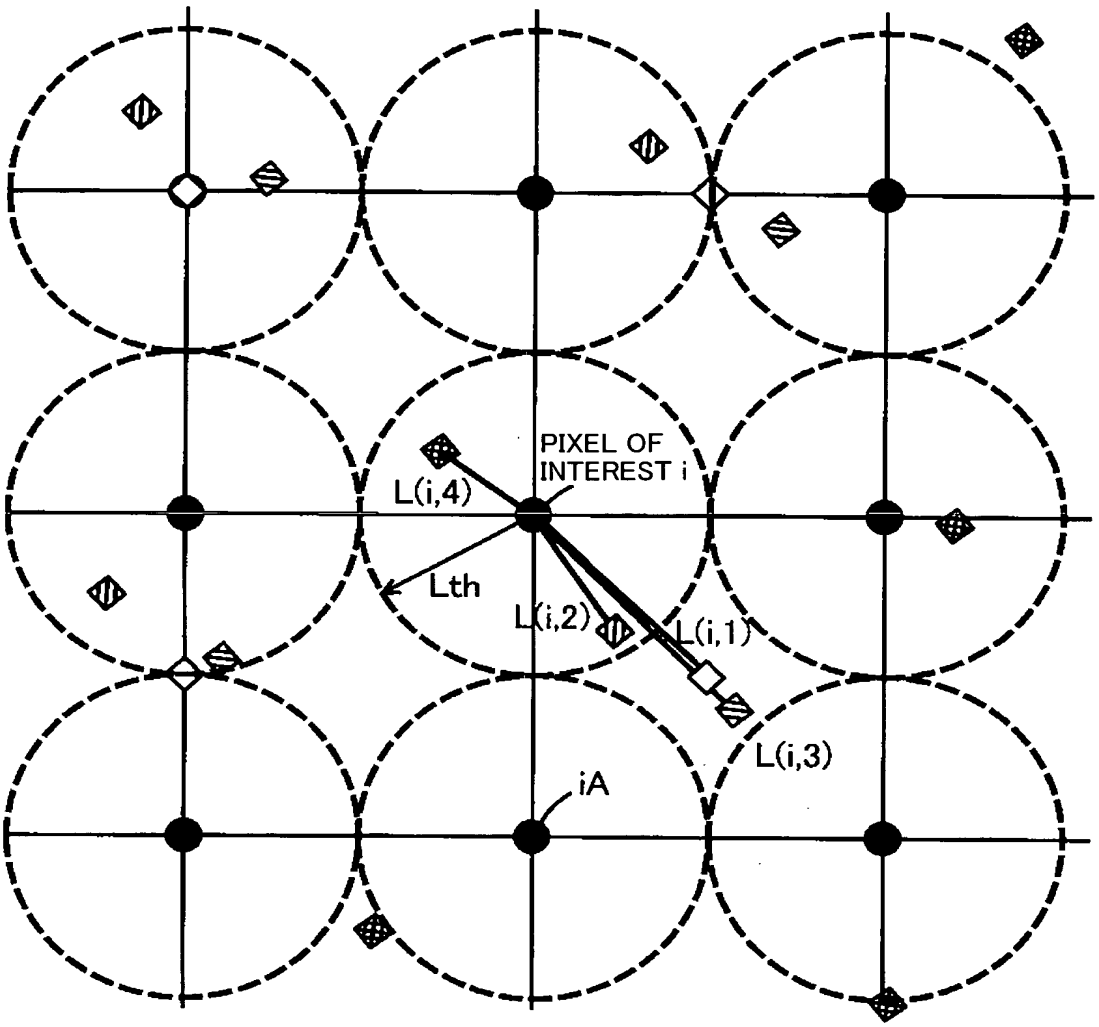

SYNTHESIS PROCESSING - PART 2
ACQUISITION OF THRESHOLD VALUE OF SHORTEST PIXEL DISTANCE Lth
S505
SETTING OF POSITION OF PIXEL OF INTEREST i THAT PRODUCES IMAGE DATA
S510
CALCULATION OF DISTANCE BETWEEN PIXEL OF INTEREST i AND PIXELS PRESENT IN VICINITY OF PIXEL OF INTEREST i AMONG ALL PIXELS OF FRAME INFORMATION
S515
SELECTION OF PIXELS EQUAL TO OR LESS THAN THRESHOLD VALUE Lth
S520
ACQUISITION OF FRAME INFORMATION INCLUDING SELECTED PIXELS
S525
INTERPOLATION PROCESSING BY FRAME INFORMATION
S530
AVERAGING OF RESPECTIVE HALFTONE DATA FOLLOWING INTERPOLATION PROCESSING
S535
ALL PIXELS COMPLETED ?
S540
NO
YES
RETURN

Fig.18



● PIXELS OF PRODUCED IMAGE

◇ PIXELS OF FRAME 1 ◈ PIXELS OF FRAME 2

◈ PIXELS OF FRAME 3 ◈ PIXELS OF FRAME 4

Fig.19

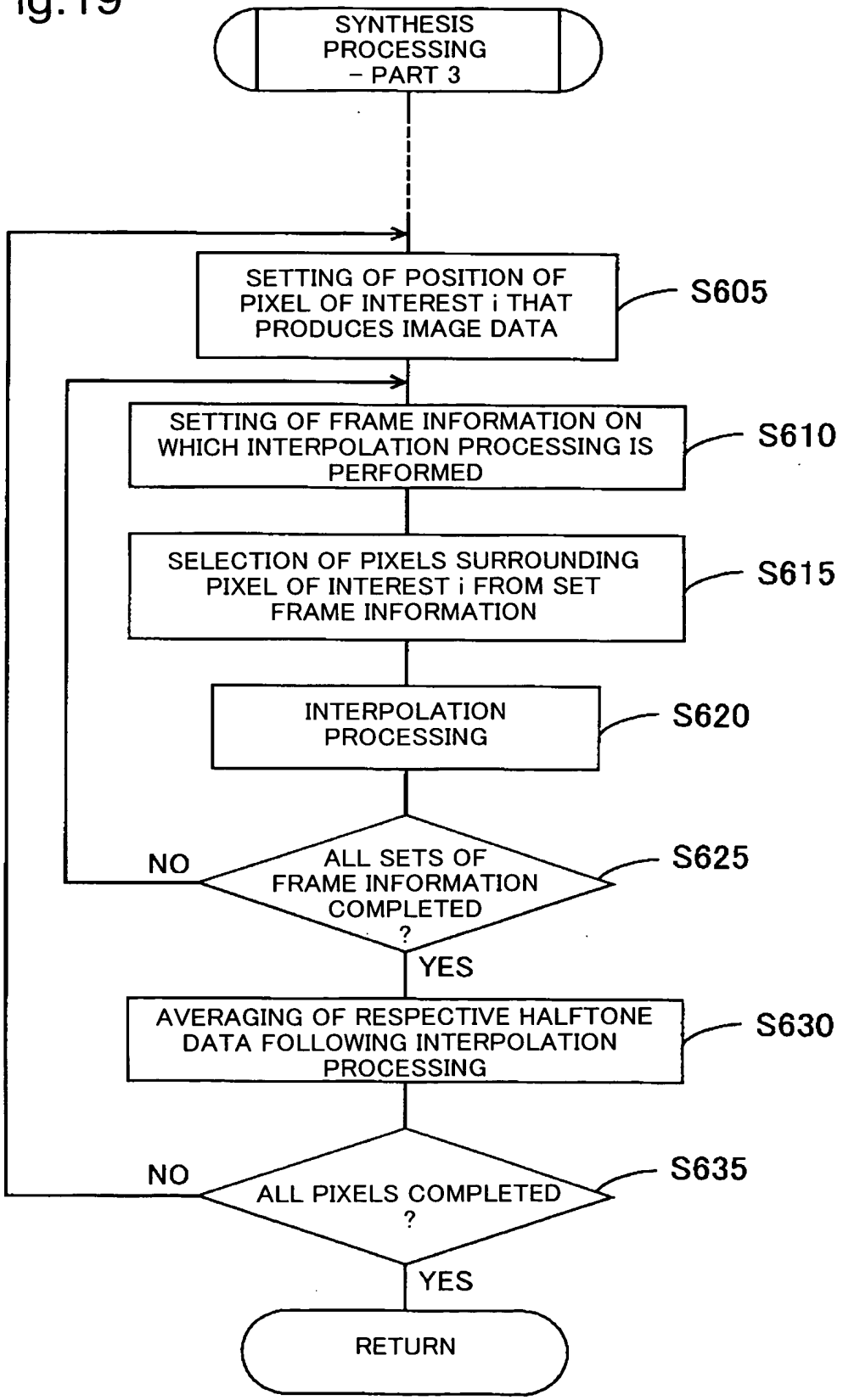
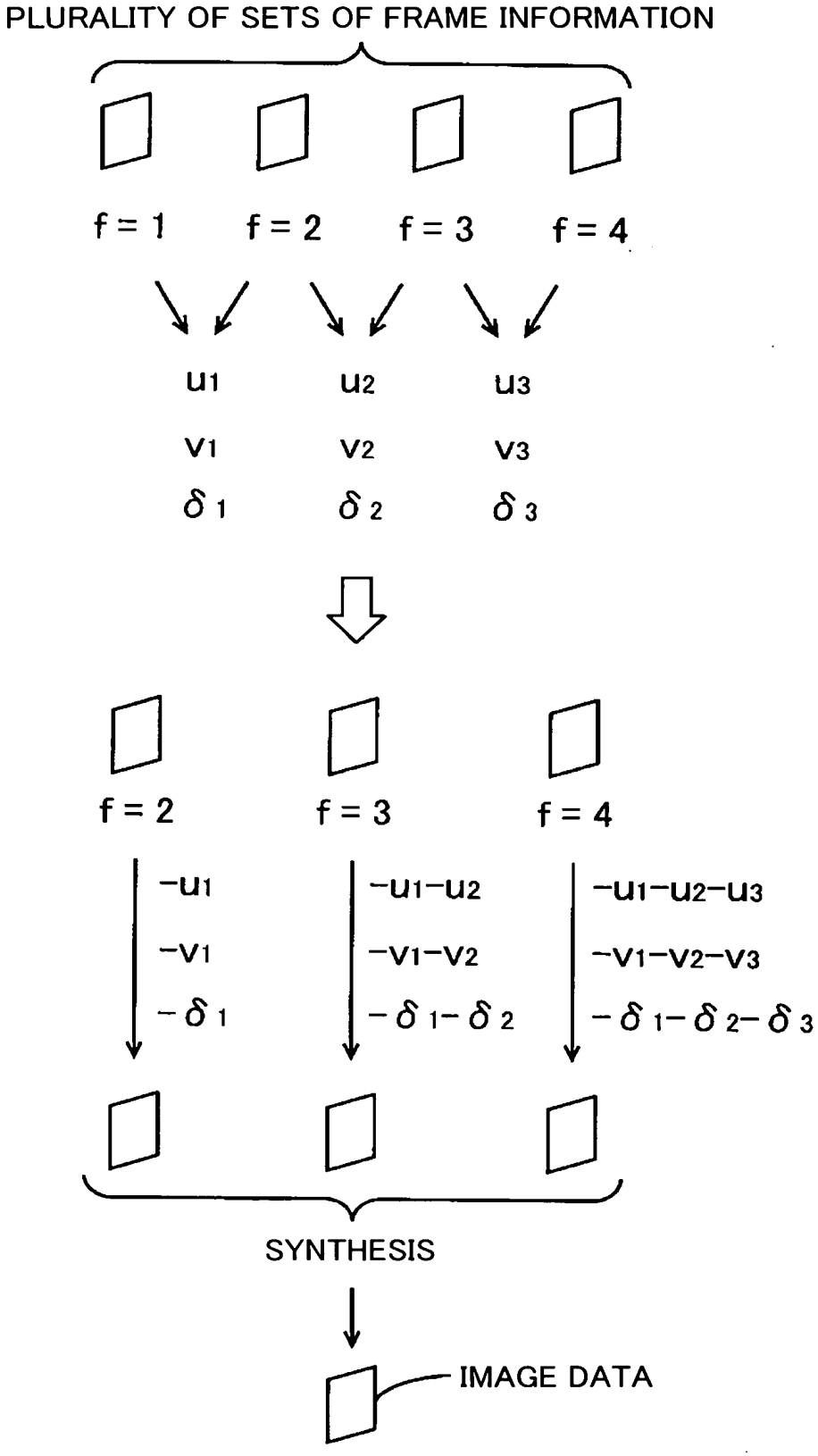

SYNTHESIS PROCESSING - PART 3
SETTING OF POSITION OF PIXEL OF INTEREST i THAT PRODUCES IMAGE DATA
S605
SETTING OF FRAME INFORMATION ON WHICH INTERPOLATION PROCESSING IS PERFORMED
S610
SELECTION OF PIXELS SURROUNDING PIXEL OF INTEREST i FROM SET FRAME INFORMATION
S615
INTERPOLATION PROCESSING
S620
NO
ALL SETS OF FRAME INFORMATION COMPLETED ?
S625
YES
AVERAGING OF RESPECTIVE HALFTONE DATA FOLLOWING INTERPOLATION PROCESSING
S630
NO
ALL PIXELS COMPLETED ?
S635
YES
RETURN

Fig.20


PLURALITY OF SETS OF FRAME INFORMATION
f = 1
f = 2
f = 3
f = 4
u1
u2
u3
v1
v2
v3
δ 1
δ 2
δ 3
f = 2
f = 3
f = 4
−u1
−v1
− δ 1
−u1−u2
−v1−v2
− δ 1− δ 2
−u1−u2−u3
−v1−v2−v3
− δ 1− δ 2− δ 3
SYNTHESIS
IMAGE DATA